

SUBSTITUTION CALL CONTROL SYSTEM  
IN ATM COMMUNICATION NETWORK

Background of the Invention

5    1. Field of the Invention

          The present invention relates to a call control in an ATM (Asynchronous Transfer Mode) subscriber communication network. More particularly, the present invention relates to a substitution call control system which substitutes a call control from a subscriber terminal in an ATM line concentrator.

10    2. Description of the Related Art

          There are PVC (Permanent Virtual Channel) and SVC (Switched Virtual Channel) in an ATM communication network, and the establishment and release of a SVC connection is controlled.

          As protocol for the control of establishment and release of the SVC connection, the following protocols are used. That is, they are:

          ITU-T recommendation Q.2110 (to be referred to as SSCOP hereinafter),

          ITU-T recommendation Q.2130 (to be referred to as SSCF hereinafter),

          ITU-T recommendation Q.2931 and ITU-T recommendation Q.2971,

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ATM Forum Technical Committee ATM UNI  
(User-Network Interface) Specification Version  
3.1 (to be referred to as UNI3.1 hereinafter),  
and

5           ATM Forum Technical Committee ATM UNI  
Signaling Specification Version 4.0 (to be  
referred to as UNI4.0 hereinafter) with respect  
to a signaling layer.

Fig. 1 is a block diagram illustrating a  
10 conventional call control system of an ATM  
communication system. In Fig. 1, an ATM  
subscriber network 11 is connected with an ATM  
switching apparatus 20 of an ATM network 10  
through a UNI (User-Network Interface) 12. The  
15 ATM subscriber network 11 is composed of an ATM  
subscriber line concentrator 30, and a plurality  
of network terminators 40a to 40c. The ATM  
subscriber line concentrator 30 accommodates the  
plurality of network terminators 40a to 40c. Each  
20 of a plurality of subscriber terminals 50a to 50c  
is connected with a corresponding one of the  
network terminators 40a to 40c.

In the conventional call control system, a  
call control function 100a is installed in the  
25 ATM switching apparatus 20 of the ATM network 10.  
Call control functions 100b and 100c are  
installed in each of the ATM subscriber line

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concentrator 30 and the network terminators 40a to 40c in the ATM subscriber network 11. Also, call control functions 100d are installed in the subscriber terminals 50a to 50c. Thus, the

5 flexibility and effective usage of the allocation of network resources in the ATM network 10 and the ATM subscriber network 11 are intended.

Fig. 2 is a diagram illustrating protocols used to realize the conventional call control

10 functions 100a to 100d shown in Fig. 1. In Fig. 2, the ATM switching apparatus 20 in the ATM network 10 is composed of a SDH layer 110a, an ATM layer 111a, an AAL5 layer 112a, an SSCOP layer 113a, an SSCF layer 114a, a signaling layer 115a and an

15 ATM switching apparatus application 130.

The ATM subscriber line concentrator 30 has two layer structures and an ATM subscriber line concentrator application 140. One of the two layer structures is composed of a SDH layer 110b,

20 an ATM layer 111b, an AAL5 layer 112b, an SSCOP layer 113b, an SSCF layer 114b, a signaling layer 115b, and the other is composed of a SDH layer 110c, an ATM layer 111c, an AAL5 layer 112c, an SSCOP layer 113c, an SSCF layer 114c, a signaling

25 layer 115c.

Each of the network terminators 40a to 40c has two layer structures and a network terminator

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application 150. One of the two layer structures is composed of a SDH layer 110d, an ATM layer 111d, an AAL5 layer 112d, an SSCOP layer 113d, an SSCF layer 114d, a signaling layer 115d, and the  
5 other is composed of a SDH layer 110e, an ATM layer 111e, an AAL5 layer 112e, an SSCOP layer 113e, an SSCF layer 114e, a signaling layer 115e.

Each of the subscriber terminals 50a to 50c is composed of a SDH layer 110f, an ATM layer  
10 111f, an AAL5 layer 112f, an SSCOP layer 113f, an SSCF layer 114f, a signaling layer 115f and a subscriber terminal application 160.

As described above, the protocol of each of the call control functions 100a to 100d is  
15 composed of:

the physical layer (SDH: Synchronous Digital Hierarchy) 110a to 110f,

the ATM layer 111a to 111f defined by ITU-T recommendation I.361,

20 the AAL5 layer (AAL: ATM Adaptation Layer) 112a to 112f defined by ITU-T recommendation I.363,

the SSCOP layer 113a to 113f defined by ITU-T recommendation Q.2110,

25 the SSCF layer 114a to 114f defined by ITU-T recommendation Q.2130, and

the signaling layer 115a to 115f for

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executing a call control.

The ATM switching apparatus 20 is provided with an ATM switching apparatus application 130 which controls the call control protocol. The ATM  
5 subscriber line concentrator 30 is provided with an ATM subscriber line concentrator application 140 which controls the call control protocol. Each of the network terminators 40a to 40c is provided with a network terminator application  
10 150 and each of the subscriber terminals 50a to 50c is provided with a subscriber terminal application 160.

Next, the operations of the call control functions shown in Fig. 1 will be described.

15 A call control procedure is executed between the call control functions 100a of the ATM switching apparatus 20 and the call control function 100b of the ATM subscriber line concentrator 30 through a channel 210a of VPI  
20 (Virtual Path Identifier )/VCI (Virtual Channel Identifier) = VP identifier/VC identifier = 0/5 defined in UNI 3.1 by UNI 12. Thus, the establishment and release of a SVC connection  
200a between the ATM switching apparatus 20 and  
25 the ATM subscriber line concentrator 30 is controlled.

A call control procedure is executed

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between the call control function 100b of the ATM subscriber line concentrator 30 and the call control function 100c of the network terminator (40: any of 40a to 40c), using an optional PVC  
5 (Permanent Virtual Channel) connection channel 210b as a call control channel. Thus, the establishment and release of the SVC connection 200b is controlled between the ATM subscriber line concentrator 30 and the network terminator  
10 40.

A call control procedure is executed between the call control function 100c of the network terminator 40 and the call control function 100d of the subscriber terminal (50: any  
15 of 50a to 50c), using an optional PVC connection channel 210c as a call control channel. Thus, the establishment and release of the SVC connection 200c is controlled between the network terminator 40 and the subscriber terminal 50.

20 However, there are the following problems in the conventional call control function described above.

The first problem is in that the network terminators 40a to 40c, and the subscriber  
25 terminal 50a to 50c are expensive in price. This is because the call control function is installed into each of the ATM subscriber line concentrator

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30, the network terminators 40a to 40c, and the subscriber terminal 50a to 50c. Because the call control functions are different depending upon the units, the development cost increases. Also, because the memory capacity is needed for the call control function, each apparatus becomes expensive. As a result, the investment to ATM subscriber network 11 increases.

In the second problem, the maintenance when the specification of the call control function is updated takes time and effort. This is because the call control functions are installed in the ATM subscriber line concentrator 30, the network terminators 40a to 40c, and the subscriber terminal 50a to 50c. In case of the update of the specification of the call control function, a software of the call control function of each of the ATM subscriber line concentrators 30, the network terminators 40a to 40c, and the subscriber terminal 50a to 50c must be updated.

In the third problem, the throughputs of the network terminators 40a to 40c, and the subscriber terminal 50a to 50c are decreased. This is because the SSCOP layer contained in the call control protocol needs to transmit and receive an SSCOP layer control ATM cell in the unit of several seconds for the establishment and

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maintenance of connection in a link layer.

Also, in a substitution call control procedure which is proposed as a proxy signaling agent (to be referred to as PSA hereinafter) in  
5 UNI 4.0 (ATM Forum Technical Committee ATM UNI Signaling Specification Version 4.0), there are two problems. That is, they are where an agent of the substitution call control should be installed in the system, and a communication system between  
10 the substitution call control agent and the application of the apparatus is not defined.

In conjunction with the above description, an ATM line concentrator is described in Japanese Laid Open Patent application (JP-A-Heisei 10-  
15 65670). In this reference, transmission path terminating circuit (16) to (18), an ATM switch (19), and a signaling terminating circuit (20) are provided. Information for executing signaling is transmitted through the transmission path  
20 terminating circuits (16) to (18) using the ATM switch (19) and the signaling terminating circuit (20). The signaling is a procedure to establish a virtual connection channel between the ATM exchanger (1) and one of the subscriber terminals  
25 (5) to (8). At this time, the transmission path terminating circuit (16) terminates a physical transmission path (9) which is accommodated by

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the ATM exchanger (1). Also, the transmission path terminating circuits (17) and (18) terminate physical transmission paths (10) and (11) which are respectively accommodated by the ATM  
5 multiplexers (3) and (4) connected to the subscriber terminals (5) to (8), for separating and multiplexing information. Thus, a wide band service can be effectively provided.

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### Summary of the Invention

An object of the present invention is to provide a substitution call control system in which a network terminator and a subscriber terminal are provided with low costs, so that an  
15 ATM subscriber network can be constructed in a low cost.

Another object of the present invention is to provide a substitution call control system including an ATM subscriber network in which  
20 maintainability of a call control function can be improved.

Still another object of the present invention is to provide a communication system which can be constructed easily as a  
25 communication system between a substitution call control function and an application.

In order to achieve an aspect of the

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present invention, a substitution call control system includes an ATM (Asynchronous Transfer Mode) subscriber network of an ATM communication network. The ATM subscriber network includes a plurality of network terminators respectively connected with a plurality of subscriber terminals, and an ATM subscriber line concentrator which accommodates VCs (Virtual Connection) to the plurality of network terminators, and is connected with a ATM switching apparatus of the ATM network through a UNI (User-Network Interface). The ATM subscriber line concentrator includes a substitution call control function to substitute for the plurality of network terminators and the subscriber terminals for a call control.

In this case, when one of the plurality of subscriber terminals issues a call processing request to the ATM subscriber line concentrator through a corresponding one of the plurality of network terminators, it is preferable that a line number connected to the one subscriber terminal and an ATM address of the one network terminator or the one subscriber terminal are held.

Also, when one of the plurality of subscriber terminals issues a call processing request to the ATM subscriber line concentrator

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through a corresponding one of the plurality of network terminators, it is preferable that a call number is held.

In addition, when a SVC (Switched Virtual Channel) connection is established in response to a call processing request issued from one of the plurality of subscriber terminals to the ATM subscriber line concentrator through a corresponding one of the plurality of network terminators, it is preferable that a VPI (Virtual Path Identifier) value and a VCI (Virtual Channel Identifier) value of the SVC connection are held.

The ATM subscriber line concentrator and each of the plurality of subscriber terminals are preferably connected by a PVC (Permanent Virtual Circuit) connection to allow a substitution call control message to be transmitted and received. Instead, the ATM subscriber line concentrator and each of the plurality of network terminators may be connected by a PVC (Permanent Virtual Circuit) connection to allow a substitution call control message to be transmitted and received.

In an either case, it is preferable that a VPI/VCI value (a value of VP identifier/VC identifier) of the PVC connection is 0/5. Also, the substitution call control message is preferably transmitted and received in a same

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protocol as that for a subscriber data. Further,  
the substitution call control message is  
transmitted and received by a Classical IP and  
ARP over ATM system defined in IETF (Internet  
5 Engineering Task Force) RFC (Request For Comment)  
1577. The substitution call control message may  
be transmitted and received by an xDSL over ATM  
system through a PVC connection, wherein the xDSL  
is a general term of various types of DSL  
10 (Digital Subscriber Line, and includes an  
Asymmetric DSL, a high-bit-rate DSL, a Rate-  
Adaptive DSL, a Symmetrical DSL and a Very-high-  
bit-rate DSL).

Each of the plurality of subscriber  
15 terminals and a corresponding one of the  
plurality of network terminators may be connected  
in IEEE 802.3 ether network.

Each of the plurality of subscriber  
terminals and a corresponding one of the  
20 plurality of network terminators may be connected  
by a PVC (Permanent Virtual Circuit) connection.  
In this case, it is preferable that a VPI/VCI  
value (a value of VP identifier/VC identifier) of  
the PVC connection is 0/5.

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#### **Brief Description of the Drawings**

Fig. 1 is a block diagram illustrating a

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conventional ATM communication apparatus;

Fig. 2 is a diagram illustrating an example of protocols for call control functions in the conventional ATM communication apparatus shown in  
5 Fig. 1;

Fig. 3 is a block diagram illustrating the structure of a substitution call control system according to a first embodiment of the present invention;

10 Fig. 4 is a diagram illustrating a management table used in the substitution call control system according to the first embodiment of the present invention;

Fig. 5 is a diagram illustrating an example  
15 of protocols used in the substitution call control system according to the first embodiment of the present invention;

Fig. 6 is a diagram format illustrating another example of the protocol of the  
20 substitution call control system according to a second embodiment of the present invention;

Fig. 7 is a block diagram illustrating the logical channel structure of an ATM subscriber network when the protocols of Fig. 5 are used for  
25 the substitution call control system in the ATM subscriber network of the present invention; and

Fig. 8 is a block diagram illustrating the

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logical channel structure of the ATM subscriber network when the protocols of Fig. 6 are used for the substitution call control function in the ATM subscriber network of the present invention.

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### Description of the Preferred Embodiments

A substitution call control system in an ATM communication apparatus of the present invention will be described below in detail with reference to the attached drawings.

Fig. 3 is a block diagram illustrating the call control system of an ATM communication apparatus of the present invention. In Fig. 3, an ATM subscriber network 11 is connected with an ATM switching apparatus 20 of an ATM network 10 through a UNI (User-Network Interface) 12. The ATM subscriber network 11 is composed of an ATM subscriber line concentrator 30, and a plurality of network terminators 40a to 40c. The ATM subscriber line concentrator 30 accommodates the plurality of network terminators 40a to 40c. Each of a plurality of subscriber terminals 50a to 50c is connected with a corresponding one of the network terminators 40a to 40c.

In the substitution call control system, a call control function 100a is installed in the ATM switching apparatus 20 of the ATM network 10.

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A substitution call control function 101 is installed in the ATM subscriber line concentrator 30 in the ATM subscriber network 11. The substitution call control function is proposed in 5 UNI 4.0. The network terminators 40a to 40c in Fig. 3 are not provided with any call control function, unlike the conventional network terminators shown in Fig. 1. Also, the subscriber terminals 50a to 50c in Fig. 3 are not provided 10 with any call control function, unlike the subscriber terminals shown in Fig. 1.


When a given one of the subscriber terminals 50a to 50c issues a call processing request to the ATM subscriber line concentrator 15 30 through a corresponding one of the plurality of network terminators 40a to 40c, a line number connected to the given subscriber terminal and an ATM address of the given network terminator or subscriber terminal are held.

20 Also, when one of the plurality of subscriber terminals issues a call processing request to the ATM subscriber line concentrator through a corresponding one of the plurality of network terminators, it is preferable that a call 25 number is held.

In addition, when a SVC (Switched Virtual Channel) connection is established in response to

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a call processing request issued from one of the plurality of subscriber terminals to the ATM subscriber line concentrator through a corresponding one of the plurality of network terminators, a VPI (Virtual Path Identifier) value and a VCI (Virtual Channel Identifier) value of the SVC connection are held. That is, the substitution call control function holds VPI/VCI values of a SVC connection when the SVC connection is established based on an ATM address for identifying another subscriber terminal, a line number to which the other subscriber terminal is connected, and a request of SVC connection establishment/release control.

15  Also, the network terminators or the subscriber terminal is subjected to IETF (Internet Engineering Task Force) RFC (Request For Comment )1577, classical IP (Internet Protocol) and ARP over ATM (to be referred to as IPOA hereinafter) and contains RFC793, TCP/RFC791, IP or RFC768 UDP/IP protocol, as to the protocol for the message transmission and reception for requesting the control establishment and release of the SVC connection to the substitution call control function of the ATM subscriber line concentrator.

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Moreover, the network terminators or the



subscriber terminal contains xDSL (Digital Subscriber Line, and including Asymmetric DSL, High-bit-rate DSL, Rate-Adaptive DSL, Symmetric DSL, and Very-high-bit-rate DSL) which is being  
5 standardized in ADSL Forum as a system for mapping to an ATM cell a message for requesting the control of establishment and release of a SVC connection to the substitution call control function of the ATM subscriber line concentrator.

10 In the present invention, any existing protocol and a communication system are used for the message for requesting the control of the establishment and release of the SVC connection between the substitution call control function of  
15 the ATM subscriber line concentrator and an application of the network terminator and the subscriber terminal. For this reason, it is possible to use the SVC connection between the ATM network and the ATM subscriber network  
20 through the substitution call control function, when a substitution call control procedure and a substitution call control message are determined between the substitution call control function and the application of each unit.

25 Also, in the present, a management table is provided such that the substitution call control function can manage ATM addresses of the network

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terminators and the subscriber terminals and SVC connections in the ATM network. Therefore, it is possible to develop the application without being conscious of the call control function in the  
5 network terminator and the subscriber terminal.

A channel 210a (VPI/VPC=0/5), which is defined in UNI 3.1, is provided between the ATM subscriber line concentrator 30 and the ATM switching apparatus 20, for transmission and  
10 reception of a call control message defined by UNI 3.1 of ATM Forum. The ATM subscriber line concentrator 30 is provided with the substitution call control function 101 to control SVC connections 200b and 200c in the ATM subscriber  
15 network 11. The substitution call control function 101, the network terminators 40a to 40c and the subscriber terminals 50a to 50c establish PVC connections 210b and 210c to transmit and receive a substitution call control message.

20 Fig. 4 is a diagram illustrating the management table 300 of the substitution call control function 101 shown in Fig. 3. The data stored in the management table 300 is composed of a line number 301, an ATM address 302, a call  
25 number 303, a VPI value 304, and a VCI value 305. The line number 301 indicates the number of a line to which each subscriber terminal 50

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accommodated in the ATM subscriber line  
concentrator 30 is connected. The ATM address 302  
is an address of the network terminator 40 or the  
subscriber terminal 50. The call number 303 is  
5 allocated when the substitution call control  
function 101 transmits and receives a call  
control message to and from the ATM switching  
apparatus 20 instead of the subscriber terminal  
50. The VPI 304 and VCI 305 values are allocated  
10 when the substitution call control function 101  
transmits and receives the call control message  
to and from the ATM switching apparatus 20  
instead of the subscriber terminals 50a to 50c.

Fig. 5 is a diagram illustrating protocols  
15 in the first embodiment of the present invention  
when there is mapped to a TCP/UDP layer, a  
substitution call control message which is  
transmitted or received between the substitution  
call control function 101 and the network  
20 terminators 40a to 40c or the subscriber terminal  
50a to 50c. The address for the network  
terminator 40 is registered as the ATM address  
302 of the management table 300.

In the UNI 12 between the ATM switching  
25 apparatus 20 of the ATM network 10 and the ATM  
subscriber line concentrator 30 of the ATM  
subscriber network 11,

SDH (Synchronous Digital Hierarchy) layers 110a and 110b,

ATM layers 111a and 111b subject to ITU-T recommendation I.361,

5 AAL5 layers 112a and 112b subject to ITU-T recommendation I.363,

SSCOP (Service Specific Connection Oriented Protocol) layers 113a and 113b subject to ITU-T recommendation Q. 2110,

10 SSCF (Service Specific Coordination Function) layers 114a and 114b subject to ITU-T recommendation Q. 2130, and

signaling layers 115a and 115b (containing ITU-T recommendation Q2931, ITU-T Q2971, UNI 3.1, 15 and UNI 4.0) are provided as the call control protocol, like the conventional apparatus shown in Fig. 1. The layers are controlled by the ATM switching apparatus application 130 and the ATM subscriber line concentrator application 140.

20 The ATM subscriber line concentrator application 140 is provided with the substitution call control function 101 and the network terminators application 150. A substitution call control protocol between the ATM subscriber line 25 concentrator application 140 and the network terminator application 150 include:

SDH/xSDL layers 116a and 116b,

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ATM layers 111c and 111d,  
AAL5 layers 112c and 112d,  
IEEE802.2 LLC/SNAP layers 117a and 117b,  
IP layers 118a and 118b, and  
5 TPC/UPD layers 119a and 119b.

The substitution call control protocol is used to  
transmit and receive the substitution call  
control message. When the SDH layer is provided,  
the system is the IPOA system, and when the xDSL  
10 layer is provided, the system uses the xDSL over  
ATM communication system and the IPOA system.

A substitution call control protocol  
between the network terminators application 150  
and the subscriber terminal application 160  
15 includes:

IEEE802.3 Ether layers 120a and 120b,  
IEEE802.5 MAC (Media Access Control) layers  
121a and 121b,  
IP layers 118b and 118c, and  
20 TPC/UDP layers 119b and 119c.

The substitution call control protocol is used to  
transmit and receive the substitution call  
control message.

Fig. 6 is a diagram is illustrating the  
25 protocol in the second embodiment of the present  
invention when the substitution call control  
message transmitted and received between the

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substitution call control function 101 and the network terminators 40a to 40c or the subscriber terminal 50a to 50c is mapped to an ATM cell.

The UNI 12 between the ATM switching  
5 apparatus 20 and the ATM subscriber line concentrator 50 includes:

SDH layers 110a and 110b,  
ATM layers 111a and 111b,  
AAL5 layers 112a and 112b,  
10 SSCOP layers 113a and 113b,  
SSCF layers 114a and 114b, and  
signaling layers 115a and 115b  
as the call control protocol, like the case of  
Fig. 5. The UNI 12 is controlled by ATM switching  
15 apparatus application 130 and the ATM subscriber line concentrator application 140 with the substitution call control function 101.

The ATM subscriber line concentrator application 140 which is provided with the  
20 substitution call control function 101, and the network terminators application 150. The substitution call control protocol between the ATM subscriber line concentrator application 140 and the network terminator application 150  
25 includes:

SDH/xDSL layers 116a and 116b,  
ATM layers 111c and 111d, and

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AAL layers 112c and 112d.

The substitution call control protocol is used to transmit and receive the substitution call control message. When the xDSL layer is provided,  
5 the system uses the xDSL over ATM communication system.

A substitution call control protocol between the network terminators application 150 and terminal application 160 includes:

10 SDH layers 110e and 110f,  
ATM layers 111d and 111f, and  
AAL5 layers 112d and 112f.

The substitution call control protocol is used to transmit and receive the substitution call  
15 control message.

The ATM network 10 determine the format of the substitution call control message to be transmitted and received between the substitution call control function 101 of the ATM subscriber  
20 line concentrator application 140 and the network terminators application 150 and the subscriber terminal application 160, to operate the substitution call control function.

Also, it is determined whether the system  
25 of the substitution call control message should be mapped to the TCP/UDP layer shown in Fig. 5 or the ATM cell shown in Fig. 6, and the ATM

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subscriber network 11 of Fig. 3 is built up.

Further, the line number 301 of the subscriber terminal 50 and the ATM address 302 as the ATM address of the network terminator 40 or the subscriber terminal 50 is set in the management table 300 which is managed by the substitution call control function 101 of the ATM subscriber line concentrator 30.

Next, the operation of the SVC connection establishment and release control in the ATM network 10 and the ATM subscriber network 11 in Fig. 3 will be described.

The ATM switching apparatus application 130 and ATM subscriber line concentrator application 140 execute a standard call control procedure through the call control channel 210a (VPI/VCI=0/5) between the ATM switching apparatus 20 and the ATM subscriber line concentrator 30 to establish the SVC connection 200a (VPI/VCI=X/Y).

In the SVC connections 200b and 200c between the ATM subscriber line concentrator 30 and the network terminator (40: 40a to 40c) and the network terminators 40 and the subscriber terminal (50: 50a to 50c), the VPI/VCI=X/Y values of the SVC connection 200a between the ATM switching apparatus 20 and the ATM subscriber line concentrator 30 are set to a predetermined

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substitution call control message. These values are informed to the network terminator application 150 of the network terminator 40 and the subscriber terminal application 160 of the subscriber terminal 50 through the PVC connections 210b and 210c (VPI/VCI=0/5, for example) by a predetermined substitution call control procedure, such that the VPI/VCI=X/Y values of the SVC connections 200b and 200c are set.

The call number when the call control procedure with ATM switching apparatus 20 is executed is stored in the call number column 303 of the management table 300 managed by the substitution call control function 101.

Also, the value X of the VPI and the value Y of the VCI of the SVC connection 200a which has been established between the ATM switching apparatus 20 and the ATM subscriber line concentrator 30 are set in the VPI column 304 and VCI column 305 of the management table 300 managed by the substitution call control function 101. Thus, the management table 300 is updated.

The ATM switching apparatus application 130 and the ATM subscriber line concentrator application 140 execute the standard call control procedure between the ATM switching apparatus 20

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and the ATM subscriber line concentrator 30 to releases the SVC connection 200a (VPI/VCY=X/Y).

5 In the SVC connections 200b and 200c between the ATM subscriber line concentrator 30 and the network terminator 40 and between the network terminator 40 and the subscriber terminal 50, when the SVC connection 200a (VPI/VCI=X/Y) between the ATM switching apparatus 20 and the ATM subscriber line concentrator 30 is released  
10 by the standard call control procedure through the call control channel 210a (VPI/VCI=0/5, for example), the VPI value of X and the VCI value of Y of the released SVC connection 200a are set to the predetermined substitution call control  
15 message and are notified to the network terminator application 150 of the network terminators 40 and the subscriber terminal application 160 of the subscriber terminal 50 through the PVC connections 210b and 210c  
20 (VPI/VCI=0/5) by the predetermined substitution call control procedure. Thus, the VPI/VCI=X/Y value of the SVC connections 200b and 200c are released.

In conjunction with the release of the SVC  
25 connections 200b and 200c, the contents of the management table 300 managed by the substitution call control function 101 are updated. That is,

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the call number 303 of the released SVC connection 200a when the call control procedure with the ATM switching apparatus 20 is executed is deleted. Also, data of the same row as the  
5 call number in the columns of VPI 304 and VCI 305 are deleted.

Fig. 7 is a block diagram illustrating the structure of the logical channel of the ATM subscriber network 11 when the protocol shown in  
10 Fig. 5 is used for the substitution call control system in the ATM subscriber network 11 of the present invention. In this case, an ATM address allocated to the network terminator is registered in the management table 300. The call control  
15 procedure is executed between the ATM switching apparatus 20 and the ATM subscriber line concentrator 30 through call control channel 210a (VPI/VCI=0/5) which is the PVC connection defined in UNI 3.1, and the establishment and release of  
20 the SVC connections 200a between the ATM switching apparatus 20 and the ATM subscriber line concentrator 30 is controlled.

The predetermined substitution call control procedure is executed between the ATM subscriber  
25 line concentrator 30 and the network terminator 40, using the call control channel 210b (VPI/VCI=0/5) (the values of VPI/VCI are same as

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those of the channel 210a) which is the PVC connection defined in UNI 3.1, and the establishment and release of the SVC connection 200b between the ATM subscriber line concentrator 30 and the network terminators 40a to 40c are controlled.

The network terminators 40 and the subscriber terminal 50 are connected by an ether net 220 so that the predetermined substitution call control procedure is executed. A connection corresponding to the SVC connections 200a or 200b between the ATM switching apparatus 20 and the ATM subscriber line concentrator 30 or between the ATM subscriber line concentrator 30 and the network terminators 40 is established and released on the ether net 220.

Fig. 8 is a block diagram illustrating the structure of the logical channel of the ATM subscriber network 11 when the protocol shown in Fig. 6 is used to the substitution call control system of the present invention in the ATM subscriber network 11. In this case, an ATM address of the subscriber terminal is registered in the management table 300.

The call control procedure is executed between the ATM switching apparatus 20 and the ATM subscriber line concentrator 30 through the

call control channel 210a (VPI/VCI=0/5) which is the PVC connection defined in UNI 3.1, and the establishment and release of the SVC connection 200a between the ATM switching apparatus 20 and the ATM subscriber line concentrator 30 is controlled.

The predetermined substitution call control procedure is executed between the ATM subscriber line concentrator 30 and the network terminator 40, using the call control channel 210b (VPI/VCI=0/5, recommended as an example) (the values of VPI/VCI are the same as those of the channel 210a), and the establishment and release of the SVC connection 200b between the ATM subscriber line concentrator 30 and the network terminator 40 are controlled.

Also, the predetermined substitution call control procedure is executed between the network terminator 40 and the subscriber terminal 50, using the call control channel 210c (VPI/VCI=0/5, recommended as the example) (the values of VPI/VCI are the same as those of the channel 210a), and the establishment and release of the SVC connection 200c between the network terminator 40 and the subscriber terminal 50 are controlled.

As described above, according to the

present invention, a network terminator and a subscriber terminal can be provided in a low cost. This is because in the ATM subscriber network 11, the substitution call control function 101 is  
5 installed only in the ATM subscriber line concentrator 30, and it is not necessity to install the standard call control function in the network terminators and the subscriber terminals. Therefore, the development expenses of the call  
10 control function for these units becomes unnecessary, and the memory quantity for these call control functions can be reduced.

As the communication system between the subscriber terminal and the network terminator,  
15 the existing protocol is used for the substitution call control function. Therefore, if the substitution call control procedure and the substitution call control message format are defined, the substitution call control function  
20 is possible to be used.

It is possible to reduce the investment expense for the ATM subscriber network. This is because the number of network terminators and the subscriber terminals contained in the ATM  
25 subscriber network is enormous. Because these unit prices are low so that the price reduction can be attained as the whole ATM subscriber

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network.

Also, the maintenance of the ATM subscriber network becomes easy. This is, only the ATM subscriber line concentrator needs to be  
5 maintained for the call control protocol of the ATM network.

Also, even in the subscriber terminal in which an adapter for the Ethernet is installed, it is possible to easily use the SVC connection  
10 of the ATM network. In the ATM subscriber line concentrator and the subscriber terminal, it is sufficient to install a simple dedicated driver for the substitution call control function  
15 message is mapped onto the TPC/IP communication and the UDP/IP communication.

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